PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-189387
(43)Date of publication of application : 11.07.2000

(51)Int.Cl. A61B 3/14
G02B 7/02
G03B 15/00
G03B 17/48

(21)Application number : 10-371799
(22)Date of filing : 28.12.1998

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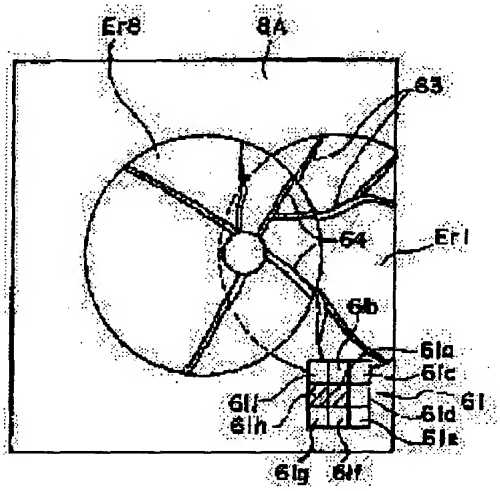
(54) OPHTHALMIC IMAGING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To produce panoramic images of regions to be imaged by photographing these regions with an observed one yet to be imaged interrelated intuitively with another or others having been imaged.
SOLUTION: The ophthalmic imaging device observes, as observation regions, partial regions to be imaged Er1 to Er8, by way of example, out of the whole region of an eye to be examined, and photographs the imaging regions Er1 to Er8, before displaying on a screen 8A a panoramic image consisting of interrelated still pictures obtained from the imaging. A display control means is provided to produce a movie display of the observation regions related to the still pictures on the screen 8A.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

(19)日本国特許庁(JP)　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開２０００－１８９３８７
(Ｐ２０００－１８９３８７Ａ)
(43)公開日　平成12年7月11日(2000.7.11)

(51)Int.Cl.'	識別記号	FI		テーマコード(参考)
Ａ６１Ｂ	3/14	Ａ６１Ｂ	3/14	Ａ 2H104
				Ｊ
				Ｚ
Ｇ０２Ｂ	7/02	Ｇ０２Ｂ	7/02	Ｊ
Ｇ０３Ｂ	15/00	Ｇ０３Ｂ	15/00	Ｔ

審査請求　未請求　請求項の数５　ＯＬ　（全９頁）　最終頁に続く

(21)出願番号　特願平10-371799

(22)出願日　平成10年12月28日(1998.12.28)

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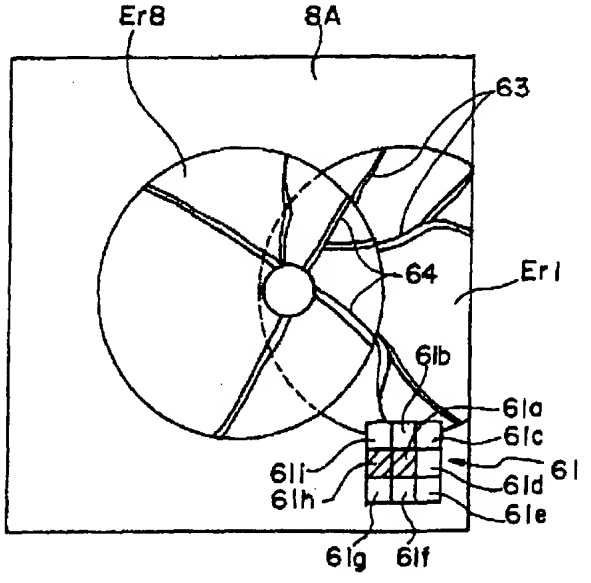
Ｆターム(参考)　2H104 AA12

(54)【発明の名称】眼科撮影装置

(57)【要約】
【課題】　これから撮影しようとする撮影すべき部位を観察しているときに、すでに撮影が終わっている撮影部位との相互関係を直感的に把握しつつ撮影を行ってパノラマ画像を得ることのできる眼科撮影装置を提供する。
【解決手段】　この発明の眼科撮影装置は、被検眼の全体に対する部分としての撮影すべき部位Ｅｒ１～Ｅｒ９を観察部位として観察した後、撮影すべき部位Ｅｒ１～Ｅｒ９を撮影してこの撮影により得られた静止画Ｅｒ１’～Ｅｒ９’を相互に関連づけてパノラマ画像として画面８Ａに表示し、画面８Ａに静止画Ｅｒ１’～Ｅｒ９’と関連づけて観察部位が動画で表示されるように制御する表示制御手段が設けられている。



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【特許請求の範囲】

【請求項１】　被検眼の全体に対する部分としての撮影すべき部位を観察部位として観察した後、前記撮影すべき部位を撮影してこの撮影により得られた静止画を相互に関連づけてパノラマ画像として画面に表示する眼科撮影装置であって、

前記画面に前記静止画と関連づけて前記観察部位が動画で表示されるように制御する表示制御手段が設けられていることを特徴とする眼科撮影装置。

【請求項２】　前記表示制御手段は前記観察部位が前記画面上の中央部分に表示されかつ前記観察部位に関連づけられる静止画が前記画面上の周辺部に表示されるように制御することを特徴とする請求項１に記載の眼科撮影装置。

【請求項３】　前記被検眼のディオプターに基づいて前記画面上での表示倍率を補正する表示倍率補正手段が設けられている請求項１に記載の眼科撮影装置。

【請求項４】　前記撮影すべき部位が眼底部位であることを特徴とする請求項３に記載の眼科撮影装置。

【請求項５】　被検眼の全体に対する部分としての撮影すべき部位を観察部位として観察した後、前記撮影すべき部位を撮影してこの撮影により得られた静止画を相互に関連づけてパノラマ画像として画面に表示する眼科撮影装置であって、前記画面に互いに関連づけて表示された各静止画のいずれかを画面上で指定する指定手段と、該指定手段により指定された静止画の画面上での輝度を調整する輝度調整手段とを備えている眼科撮影装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、被検眼の眼底、角膜内皮、角膜断面等の撮影部位を撮影する眼科撮影装置の改良に関する。

【０００２】

【従来の技術】従来から、被検眼の眼底、角膜内皮、角膜断面等の撮影部位を撮影する眼科撮影装置が知られている。この種の眼科撮影装置、例えば、眼底を撮影する眼底カメラでは、眼底の全体に対する部分としての撮影すべき各部位を観察部位（アライメント画像）としてモニタの画面上に動画で表示し、この画面上に表示された各観察部位を観察しつつそれぞれ撮影して、この撮影により得られた撮影すべき各部位を静止画としてスチルビデオレコーダー等に記録し、この撮影により得られた各静止画を相互に関連づけてパノラマ画像として画面に表示するようにしている。

【０００３】

【発明が解決しようとする課題】しかしながら、この種の眼科撮影装置では、各眼底部位を関連づけてモニタの画面上に静止画として表示するものとしたとき、得られた各静止画を関連づけて貼り合わせて合成する作業が煩わしく、各静止画を間違って関連づけるおそれもあり、

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被検眼の全体を広い範囲で検査する場合に問題になっている。

【０００４】そこで、特開平９－１７３２９８号公報に開示のものでは、被検眼の撮影すべき部位を選択する位置選択手段を設け、撮影すべき部位を撮影により静止画として記録手段に記録すると共に位置選択手段により選択された撮影位置を記録手段に記録し、画像制御手段が撮影位置に基づいて各静止画を関連づけて画面に表示させるようにしている。

【０００５】このものによれば、得られた各静止画を関連づけて貼り合わせて合成する作業に煩わされることなく、また、各静止画を間違って関連づけるおそれもない。

【０００６】ところが、この特開平９－１７３２９８号公報に開示のものでは、被検眼を観察しているときには、すでに撮影の終わっている撮影部位が画面上に表示されず、画面上にはこれから撮影しようとする撮影すべき部位が動画で表示されるのみであるので、これから撮影しようとする撮影すべき部位を観察しているときにすでに撮影が終わっている撮影部位との相互関係を直感的に把握しにくいという問題がある。

【０００７】本発明は、上記の事情に鑑みて為されたもので、その目的とするところは、これから撮影しようとする撮影すべき部位を観察しているときに、すでに撮影が終わっている撮影部位との相互関係を直感的に把握しつつ撮影を行ってパノラマ画像を得ることのできる眼科撮影装置を提供することにある。

【０００８】

【課題を解決するための手段】本発明の請求項１に記載の眼科撮影装置は、被検眼の全体に対する部分としての撮影すべき部位を観察部位として観察した後、前記撮影すべき部位を撮影してこの撮影により得られた静止画を相互に関連づけてパノラマ画像として画面に表示する眼科撮影装置であって、前記画面に前記静止画と関連づけて前記観察部位が動画で表示されるように制御する表示制御手段が設けられていることを特徴とする。

【０００９】本発明の請求項２に記載の眼科撮影装置は、前記表示制御手段は前記観察部位が前記画面上の中央部分に表示されかつ前記観察部位に関連づけられる静止画が前記画面上の周辺部に表示されるように制御することを特徴とする。

【００１０】本発明の請求項３に記載の眼科撮影装置は、前記被検眼のディオプターに基づいて前記画面上での表示倍率を補正する表示倍率補正手段が設けられていることを特徴とする。

【００１１】本発明の請求項４に記載の眼科撮影装置は、前記撮影すべき部位が眼底部位であることを特徴とする本発明の請求項５に記載の眼科撮影装置は、被検眼の全体に対する部分としての撮影すべき部位を観察部位として観察した後、前記撮影すべき部位を撮影してこの

撮影により得られた静止画を相互に関連づけてパノラマ画像として画面に表示する眼科撮影装置であって、前記画面に互いに関連づけて表示された各静止画のいずれかを画面上で指定する指定手段と、該指定手段により指定された静止画の画面上での輝度を調整する輝度調整手段とを備えていることを特徴とする。

【００１２】

【発明の実施の形態】図１は本発明に係わる眼科撮影装置の一例としての無散瞳タイプの眼底カメラの外観図を示し、この図１において、１Ａはベース、１Ｂは架台、１Ｃは装置本体、２は顎受け、３は額当て、４は外部固視灯、５Ａはジョイスティック、５Ｂは撮影スイッチ、６はＴＶカメラであり、これらの構成は公知である。

【００１３】装置本体の内部には、図２に示すように被検眼Ｅの眼底Ｅｒを照明するための照明光学系１０と眼底Ｅｒを撮影する撮影光学系２０と、観察光学系２０’と、眼底Ｅｒに固視標を投影して被検眼を固視させるための内部固視標投影光学系５０と、被検眼に対する装置本体の位置合わせを行うためのアライメント光学系（図示を略す）とを備えている。

【００１４】照明光学系１０は対物レンズ１１と、孔空きミラー１２と、リレーレンズ１３と、反射ミラー１４と、リレーレンズ１５と、被検眼Ｅの瞳孔Ｅａと共役関係に保たれたリング開口１６Ａを有するリング開口板１６と、コンデンサレンズ１７と、照明光源１８とを有している。

【００１５】照明光学系１０は観察時には赤外光により眼底を照明し、撮影時には可視光により眼底を照明するもので、その構成は公知であるのでその詳細な説明は省略する。

【００１６】撮影光学系２０は、対物レンズ１１と、合焦レンズ２１と、結像レンズ２２と、反射ミラー２３を有し、ＴＶカメラ６は撮像素子６ａを有する。ＴＶカメラ６はフィールドレンズ２４と、反射ミラー２５と、リレーレンズ２６とからなるリレーレンズ系２５Ａを介して撮影光学系２０に光学的に接続されている。その撮像素子６ａは眼底Ｅｒと光学的に共役関係に維持される。

【００１７】観察光学系２０’はダイクロイックミラー２３’、反射ミラー２５’、リレーレンズ２６’、ＴＶカメラ６’を有する。ダイクロイックミラー２３’は赤外光を反射し、可視光を透過する特性を有する。

【００１８】ＴＶカメラ６は画像記録器機器としてのスチルビデオレコーダー７に接続され、このスチルビデオレコーダー７はモニター８に接続されている。そのモニター８には、その画面８Ａに被検眼の眼底を撮影するときに眼底の全体に対する部分としての撮影すべき部位が観察部位として動画で表示される。

【００１９】検者はその観察部位を観察しつつアライメントを行って撮影を行う。その撮影すべき部位は静止画としてスチルビデオレコーダー７に記録される。そのスチルビデオレコーダー７に記録された静止画は画面８Ａに表示されるようになっている。そのモニター８、スチルビデオレコーダー７は制御装置９によって制御され、その制御の詳細は後述する。

【００２０】内部固視標投影光学系５０は、図３に示すように、中心に配置された発光ダイオード５１ａ及びこの発光ダイオード５１ａの周囲に等間隔に正方形状に配置された８個の発光ダイオード５１ｂ～５１ｉと、図４に示すように各発光ダイオード５１ａ～５１ｉに対向して設けられたピンホール５２ａ～５２ｉを有するマスク板５２と、ハーフミラー５３と、結像レンズ２２と、合焦レンズ２１と、対物レンズ１１とからなる。

【００２１】この発光ダイオード５１ａ～５１ｉの光はピンホール５２ａ～５２ｉ、ハーフミラー５３、結像レンズ２２、合焦レンズ２１、対物レンズ１１を介して眼底Ｅｒに固視標として投影され、眼底Ｅｒにピンホール像が結像され、被検者はこの固視標を視認することにより固視が固定され、このピンホール５２ａ～５２ｉのいずれを点灯させるかによって、撮影光学系２０の光軸Ｏに対する被検者の固視の方向が切り換えられ、これにより眼底Ｅｒの撮影すべき部位が変更されるものである。ここでは、眼底Ｅｒの撮影すべき部位は図５に示すように９個とした。

【００２２】発光ダイオード５１ａを点灯させると、中央の撮影すべき部位Ｅｒ１が撮影され、発光ダイオード５１ｂを点灯させると、真上の撮影すべき部位Ｅｒ２が撮影され、発光ダイオード５１ｃを点灯させると、右斜め上の撮影すべき部位Ｅｒ３が撮影され、発光ダイオード５１ｄを点灯させると、右横の撮影すべき部位Ｅｒ４が撮影され、発光ダイオード５１ｅを点灯させると、右斜め下の撮影すべき部位Ｅｒ５が撮影され、発光ダイオード５１ｆを点灯させると、真下の撮影すべき部位Ｅｒ６が撮影され、発光ダイオード５１ｇを点灯させると、左斜め下の撮影すべき部位Ｅｒ７が撮影され、発光ダイオード５１ｈを点灯させると、左横の撮影すべき部位Ｅｒ８が撮影され、発光ダイオード５１ｉを点灯させると、左斜め上の撮影すべき部位Ｅｒ９が撮影されるようになっている。

【００２３】モニター８の画面８Ａには、図６に示すように、撮影の前には、眼底Ｅｒの全体に対する部分としての撮影すべき部位がアライメント画像として表示される。このアライメント画像は動画である。この図６では、被検眼が発光ダイオード５１ａを固視しているものとして、画面８Ａにはその略中央部に撮影すべき部位Ｅｒ１が動画で表示されている。

【００２４】制御装置９はマウス等の操作手段６０を有し、画面８Ａには操作手段６０を操作することにより、アライメント画像、静止画像と共に、眼底Ｅｒの全体に対する撮影すべき部位の位置を認識させる認識パターン６１が表示される。眼底部位Ｅｒ２～Ｅｒ９については

未撮影であるので、図６においては、撮影すべき部位Ｅｒ１のみが表示され、後述する静止画は表示されていない。

【００２５】認識パターン６１は、ここでは、９個の升目６１ａ～６１ｉから構成され、この９個の升目６１ａないし６１ｉは撮影部位Ｅｒ１～Ｅｒ９にそれぞれ対応する位置関係をもって配置されている。この認識パターン６１は、例えば撮影すべき部位の撮影が実行されると、その撮影すべき部位に対応する升目の輝度が高くなるようにされ、全く撮影の行われていない状態では、各升目６１ａ～６１ｉの輝度は低輝度であり、例えば、中央の部位Ｅｒ１のアライメント画像が表示されている状態で撮影スイッチ５Ｂを操作することにより撮影を実行すると、升目６１ａが低輝度から高輝度に変更され、これにより、眼底Ｅｒの全体に対する撮影すべき部位のいずれの位置の撮影すべき部位の撮影が行われたかが認識される。その撮影すべき部位Ｅｒ１はスチルビデオレコーダー７に静止画Ｅｒ１’として記録される。次に、発光ダイオード５１ｈを点灯させて被検眼Ｅの固視を誘導すると、図７に示すように画面８Ａに撮影すべき部位Ｅｒ８に対応するアライメント画像が動画で表示される。撮影すべき部位Ｅｒ８は画面８Ａの略中央部に表示される。

【００２６】操作手段６０を操作して画面８Ａ上で所望の静止画（ここでは、Ｅｒ１’）の呼び出し指定をすると、静止画Ｅｒ１’が表示されると共に認識パターン６１が表示される。この操作手段６０を操作して画面８Ａ上で観察を指定すると、静止画Ｅｒ１’はアライメント画像Ｅｒに対して相対位置関係を保って画面８Ａ上の周辺部に移動され、画面８Ａには静止画Ｅｒ１’の一部が表示され、制御装置９と操作手段６０とは、画面８Ａ上に静止画と関連づけて観察部位が動画で表示されるように制御する表示制御手段として機能する。

【００２７】これにより、これから撮影しようとする撮影すべき部位を観察しているときに、すでに撮影が終わっている撮影部位との相互関係を直感的に把握しつつ撮影を行ってパノラマ画像を得ることができる。また、観察部位を縮小することなく画面上に表示して静止画と観察部位とを関連づけることができる。

【００２８】この状態で、撮影スイッチ５Ｂを操作することにより撮影を実行すると、升目６１ｈが低輝度から高輝度に変更され、眼底撮影部位Ｅｒ８の撮影部位が実行されたことが画面８Ａに表示される。その図７において、撮影が実行されて高輝度になった升目６１ａ、６１ｈを斜線で示す。同時に、眼底撮影部位Ｅｒ８がスチルビデオレコーダー７に記録される。制御装置９は各撮影部位Ｅｒ１～Ｅｒ９をスチルビデオレコーダー７に記録する際に、各撮影部位Ｅｒ１～Ｅｒ９と共に撮影部位情報を記録させる。ここでは、撮影部位情報として同一符号Ｅｒ１～Ｅｒ９が用いられる。

【００２９】ところで、この眼科撮影装置では、被検眼のディオプターを０度（正常）とみなして、各撮影すべき部位Ｅｒ１～Ｅｒ９の相対位置関係を計算して画面８Ａに表示するようにしている。しかしながら、被検眼のディオプターが０度でないとき、すなわち、近視、遠視の被検眼の場合、撮影倍率が異なるため、図８に示すように、撮影済みの静止画とこれに隣接する動画とを精度良くつなげることができないという問題点がある。

【００３０】被検眼のディオプターと撮影倍率との間には、一定の関係があるので、図１に示す合焦ハンドル２１Ａを用いて図２に示す合焦レンズ２１を光軸方向に移動させて合焦を行ったときのディオプター値に基づいて、画面８Ａ上での表示倍率を制御装置９により補正するようにすると、図９に示すように撮影済みの静止画とこれに隣接する動画とを精度良くつなげることができる。合焦ハンドル２１Ａの周囲には、図１０に示すように、正視眼位置の基準マーク２１Ｂ、＋ａ（ディオプタ）、－ａ（ディオプタ）の目盛２１Ｃが設けられ、合焦ハンドル２１Ａを操作することにより合焦レンズ２１が移動され、合焦した時点で合焦ボタン２１Ｄを押すと、被検眼のディオプターが制御装置９に記憶され、これにより表示倍率の変更が行われる。このとき、制御装置９は被検眼のディオプター値に基づいて表示倍率を補正する表示倍率補正手段として機能する。

【００３１】各撮影すべき部位Ｅｒ１～Ｅｒ９を撮影し終わって操作手段６０を操作すると、画面８Ａには図１１に示すように静止画Ｅｒ１’～Ｅｒ９’により眼底像が全体像（パノラマ画像）として表示される。ここで、各静止画Ｅｒ１’～Ｅｒ９’の輝度を見較べてみて、非常に輝度の高い静止画、あるいは、低い静止画があったとする。

【００３２】その場合には、その輝度の高い静止画、あるいは、低い静止画をマウス等の操作手段６０によりカーソルを移動させてカーソルの位置する画像上でクリックして指定する。すると、その指定された静止画が画面８Ａの表面に現れると同時に、画面８Ａに輝度調整仮想スライドツマミ６２が表示される。

【００３３】操作手段６０により輝度調整仮想スライドツマミ６２を画面上で操作して隣り合う静止画の輝度と違和感のない輝度とすることができ、違和感無く各静止画を連続的につなげて全体の被検眼像を合成できる。

【００３４】また、図１２に各静止画Ｅｒ１’～Ｅｒ９’を並列的に表示し、各静止画Ｅｒ１’～Ｅｒ９’の明るさを見較べて、各静止画Ｅｒ１’～Ｅｒ９’毎に輝度調整指定を行い、各静止画毎の輝度調整を行っても良い。

【００３５】この発明の実施の形態では、固視標としての発光ダイオード５１ｂ～５１ｉを発光ダイオード５１ａを中心にして正方形状の配列としたので、図１１に示す隣接する眼底部位の静止画（眼底像）の重なり部分を

少なくすることができるという長所があるが、図１３（ａ）に示すように発光ダイオード５１ｂ～５１ｉを発光ダイオード５１ａを中心にして円周上に配列すると共に、図１３（ｂ）に示すようにマスク板５２のピンホール５２ａ～５２ｉを発光ダイオード５１ａ～５１ｉに対応させて配列し、図１４に示すように静止画Ｅｒ１’～Ｅｒ９’を画面８Ａ上に表示するようにしても良い。

【００３６】ここでは、眼底中央を中心に８０度の範囲内の眼底像が撮影できるようにされているが、１００度、１２０度の範囲内の眼底像を撮影できるようにしても良い。

【００３７】また、内部固視標として任意に位置変更可能な可動固視標を用い、図１５に示すように、撮影前に円形枠Ｃｉを画面８Ａの中央に表示し、この画面８Ａ内に撮影すべき眼底部位を動画として表示し、可動固視標を基準位置から変位させるに伴って撮影されるべき眼底部位を変化させると共に、可動固視標の基準位置からの変位量に応じて画面８Ａ上での円形枠の位置を中央位置から変化させるようにしても良い。

【００３８】以上の発明の実施の態では、内部固視を用いてパノラマ撮影を行う場合について説明したが、外部固視を用いて撮影を行うようにしても良い。

【００３９】外部固視を用いて撮影を行う場合、撮影すべき範囲が広範囲であり、検者は撮り残し部位がないように経験と勘とに頼って、図１６に示すように、隣接する撮影像がかなり重なり合うようにして撮影を行っている。その図１６には、符号Ｅｒ１～Ｅｒ１５の１５枚の静止画の互いに隣接する画像同士がかなりの部分で重なり合った状態が示されている。

【００４０】従って、従来は、外部固視を用いて眼底像のパノラマ撮影を行う場合、撮影枚数が多くなり、フィルムを浪費するという問題があった。そこで、図１７に示すように、画面８Ａの中央部分に円形枠Ｃｉを表示し、外部固視標による被検眼の誘導に伴って画面８Ａ上に表示されている眼底部位としての動画を円形枠Ｃｉ内で変化させると共に、外部固視標の基準位置からの変位量に対応させて、円形枠Ｃｉに対する撮影済みの静止画を相対的に画面８Ａ上で移動させるようにしても良い。ここでは、撮影済みの静止画として静止画Ｅｒ４’が画面８Ａ上に表示されている。

【００４１】このものによれば、画面８Ａの静止画としての眼底像を見つつこれから撮影しようとする円形枠Ｃｉ内の動画の静止画に対する位置関係を正しく把握しつつかつ隣接する眼底像の重なりを極力少なくしつつパノラマ画像を得ることができる。

【００４２】

【発明の効果】本発明の請求項１に記載の眼科撮影装置によれば、これから撮影しようとする撮影すべき部位を観察しているときに、すでに撮影が終わっている撮影部ラマ画像を得ることができるという効果を奏する。

【００４３】本発明の請求項２に記載の眼科撮影装置によれば、観察部位を動画として画面の中央部に表示し、静止画はその一部を画面の周辺部に表示するようにしたので、観察部位をほとんど縮小することなく画面上に表示して静止画と観察部位とを関連づけることができる。

【００４４】本発明の請求項３、４に記載の眼科撮影装置によれば、被検眼のディオプターに基づく撮影倍率の変化を補正でき、隣り合う各静止画をより精度よくつなげることができ、特に眼底像をパノラマ画像として各眼底部位の血管を画面上で正確につなげて表示できる。

【００４５】本発明の請求項５に記載の眼科撮影装置によれば、画面に互いに関連づけて表示された各静止画のいずれかを画面上で指定する指定手段と、この指定手段により指定された静止画の画面上での輝度を調整する輝度調整手段とを備えているので、画面上に表示された各静止画の輝度が異なっている場合でも、違和感無く各静止画を連続的につなげて全体の被検眼像を合成できるという効果を奏する。

【図面の簡単な説明】

【図１】本発明に係わる眼科撮影装置の外観図である。

【図２】本発明に係わる眼科撮影装置の光学図である。

【図３】図２に示す発光ダイオードの配列状態を示す図である。

【図４】図２に示すマスク板の平面図である。

【図５】撮影されるべき眼底部位の区分を示す図である。

【図６】撮影すべき部位Ｅｒ１が動画で画面に表示されている状態を説明するための図である。

【図７】撮影済みの部位Ｅｒ１が静止画Ｅｒ１’で表示されると共に撮影すべき部位Ｅｒ８が動画で表示されている状態を説明するための図である。

【図８】被検眼のディオプターが正視眼からずれているとき撮影倍率が変化するために、画面上に表示された静止画Ｅｒ１’と撮影すべき部位Ｅｒ８とがずれることを説明するための図である。

【図９】表示倍率を補正して図８に示す静止画Ｅｒ１’の血管と撮影すべき部位Ｅｒ８の血管とを正確につなげた状態を示す図である。

【図１０】図１に示す合焦ハンドルの詳細を説明するための部分拡大図である。

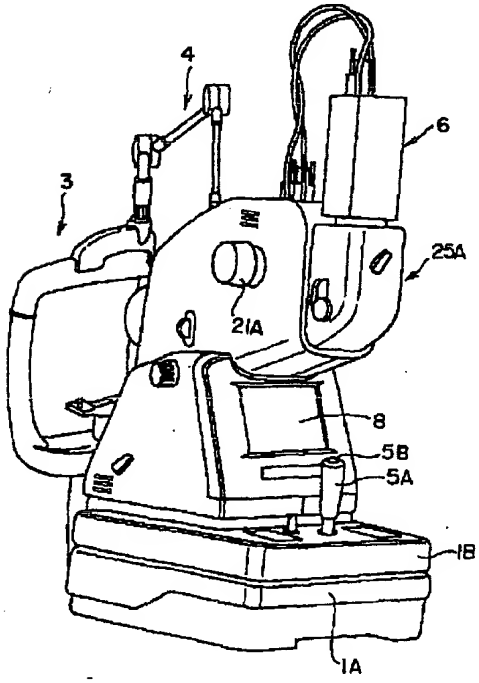
【図１１】画面上に各静止画をつなげてパノラマ画像として表示した状態を示す図である。

【図１２】画面上に各静止画を縮小して並列的に表示した状態を示す図である。

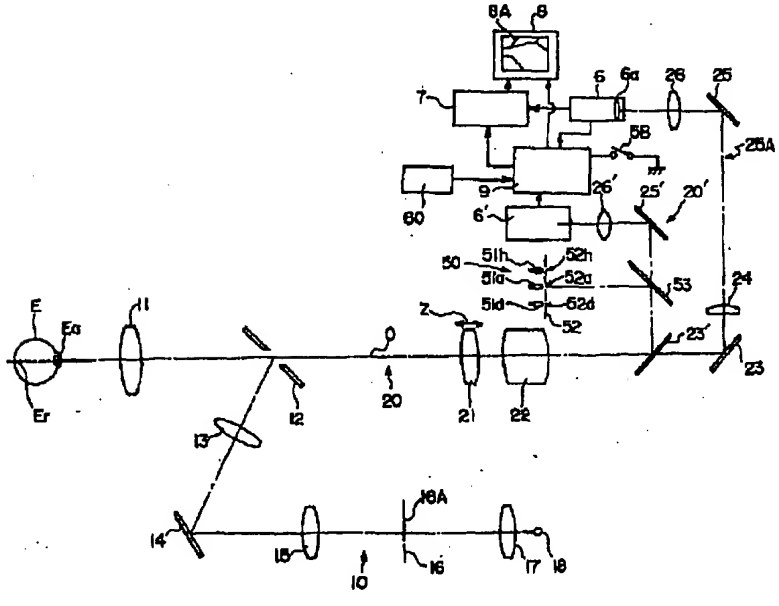
【図１３】図３に示す発光ダイオードと図４に示すマスク板との変形例を説明するための図であって、（ａ）は発光ダイオードの配列の変形例を示し、（ｂ）はピンホールの配列の変形例を示す。

得られたパノラマ画像を説明するための図である。
【図１５】内部固視標を可動の構成として得られた動画像を説明するための説明図である。
【図１６】外部固視標を用いて従来のパノラマ画像を得る場合の説明図である。
【図１７】画面上に静止画Ｅｒ４’を表示すると共に、撮影すべき部位Ｅｒ１１を動画で円形枠Ｃｉ内に表示した状態を示す図である。
【符号の説明】
８Ａ…画面
９…制御装置（表示制御手段）
６０…操作手段（表示制御手段）
Ｅｒ１～Ｅｒ９…撮影すべき部位
Ｅｒ１’～Ｅｒ９’…静止画

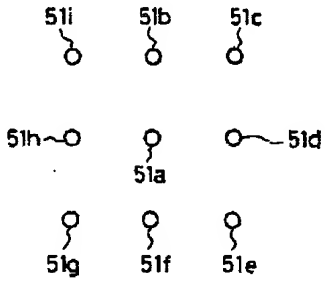
【図１】



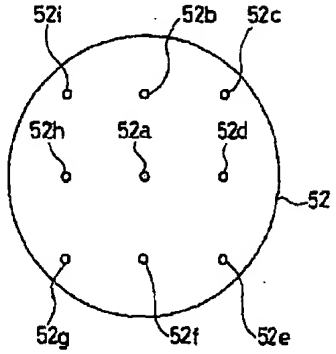
【図２】



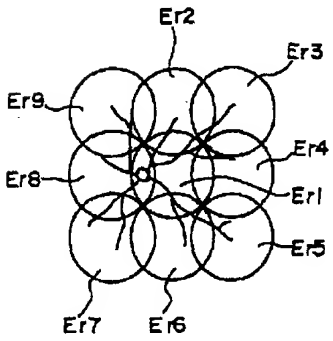
【図３】



【図４】



【図５】



PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2000-189387**
(43)Date of publication of application : **11.07.2000**

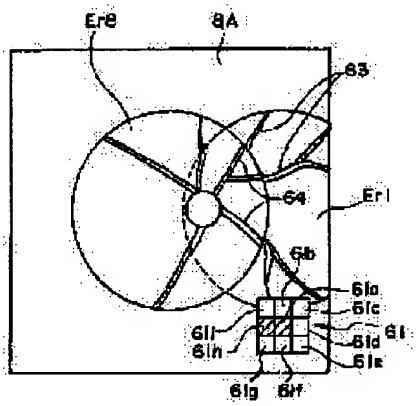
(51)Int.Cl. **A61B 3/14**
G02B 7/02
G03B 15/00
G03B 17/48

(21)Application number : **10-371799**
(22)Date of filing : **28.12.1998**

(71)Applicant : **TOPCON CORP**
(72)Inventor : **OKASHITA TOSHIHIRO**
KATO TAKEYUKI

(54) OPHTHALMIC IMAGING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To produce panoramic images of regions to be imaged by photographing these regions with an observed one yet to be imaged interrelated intuitively with another or others having been imaged.
SOLUTION: The ophthalmic imaging device observes, as observation regions, partial regions to be imaged Er1 to Er8, by way of example, out of the whole region of an eye to be examined, and photographs the imaging regions Er1 to Er8, before displaying on a screen 8A a panoramic image consisting of interrelated still pictures obtained from the imaging. A display control means is provided to produce a movie display of the observation regions related to the still pictures on the screen 8A.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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2.**** shows the word which can not be translated.
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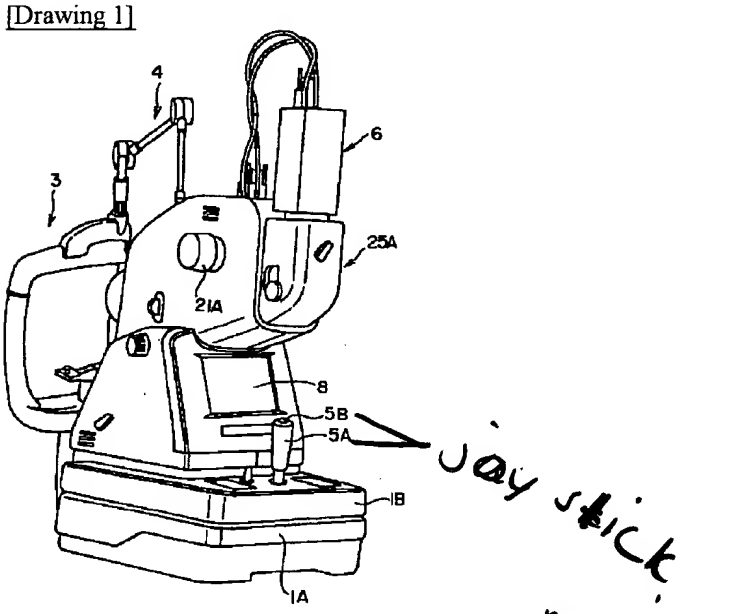
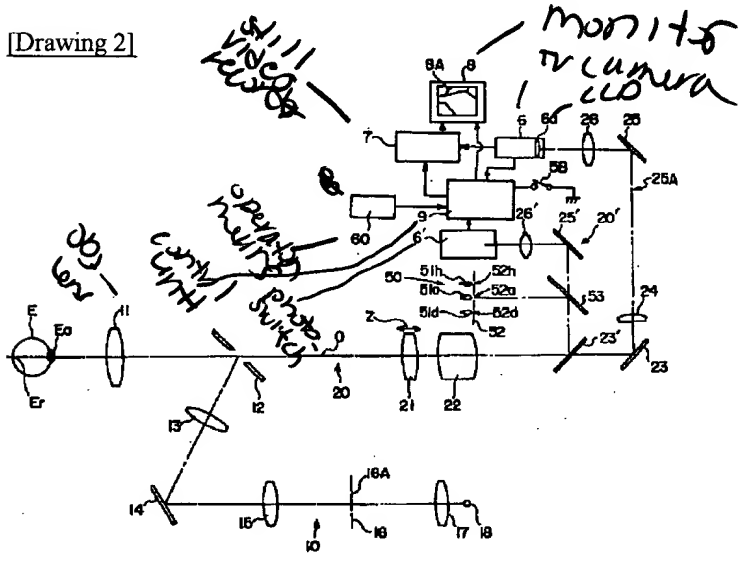
DRAWINGS

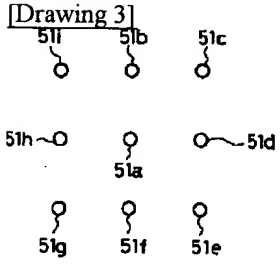
[Drawing 1]



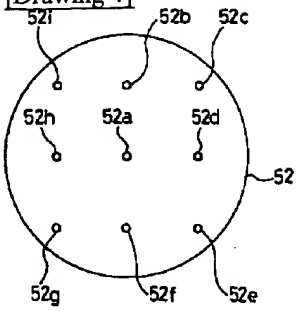
[Drawing 2]



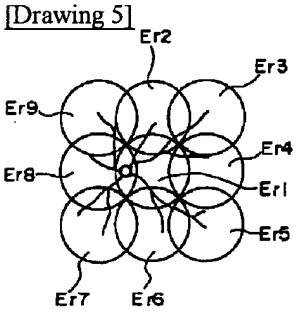
[Drawing 3]



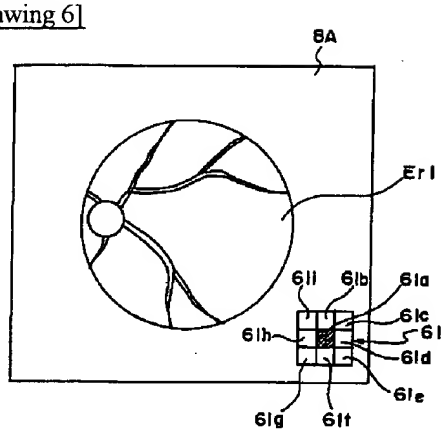
[Drawing 4]



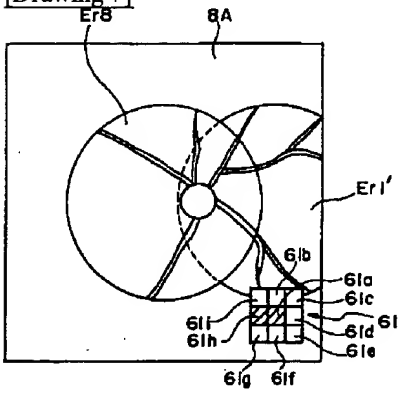
[Drawing 5]



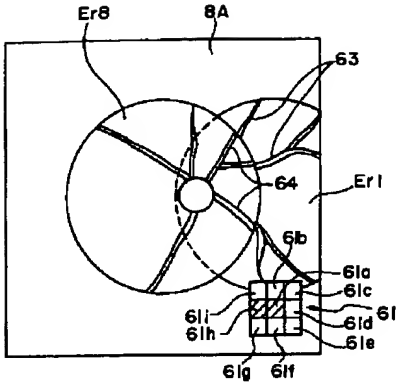
[Drawing 6]



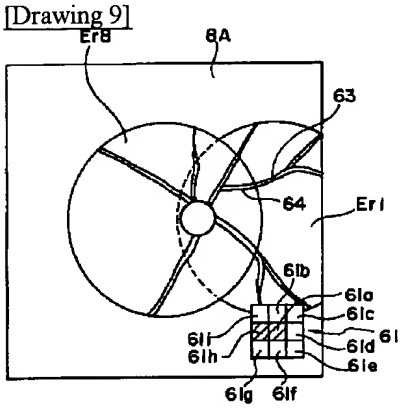
[Drawing 7]



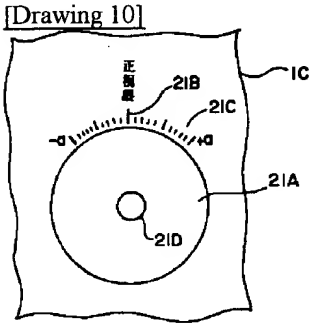
[Drawing 8]



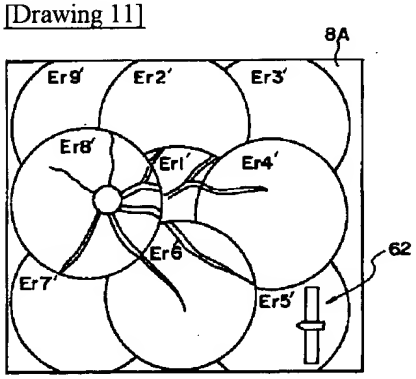
[Drawing 9]



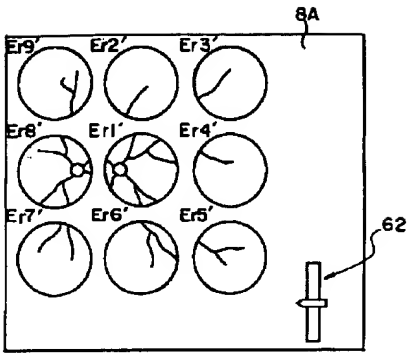
[Drawing 10]



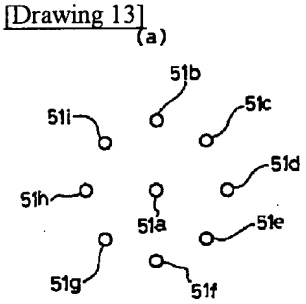
[Drawing 11]

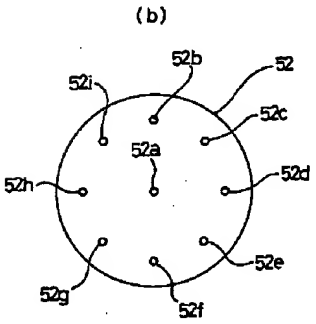


[Drawing 12]

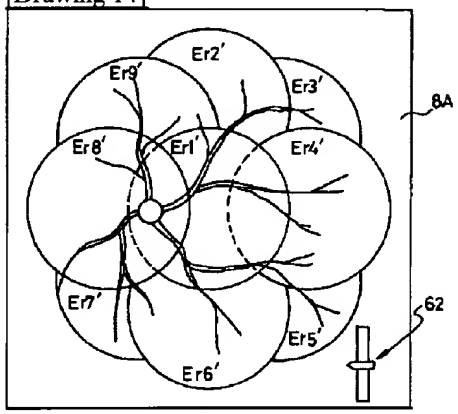


[Drawing 13]

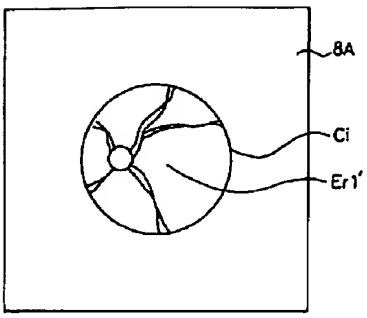




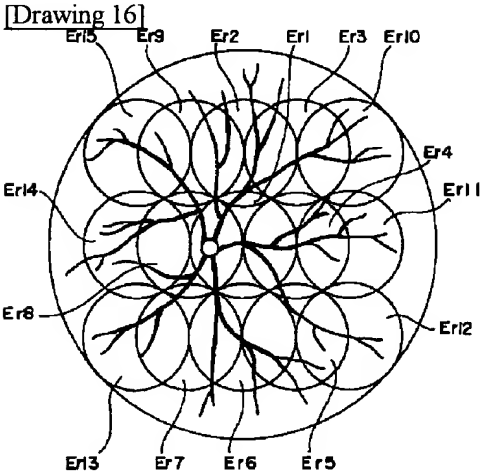
[Drawing 14]



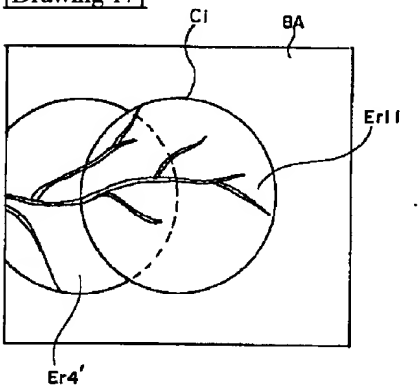
[Drawing 15]



[Drawing 16]



[Drawing 17]



[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the external view of the ophthalmology photography equipment concerning this invention.
[Drawing 2] It is the optical view of the ophthalmology photography equipment concerning this invention.
[Drawing 3] It is drawing showing the array state of light emitting diode shown in drawing 2 .
[Drawing 4] It is the plan of the mask board shown in drawing 2 .
[Drawing 5] It is drawing showing the partition of the eyegrounds part which should be photoed.
[Drawing 6] It is drawing for explaining the state where the part Er1 which should be photoed is displayed on the screen by the animation.
[Drawing 7] It is drawing for explaining the state where the part Er8 which should be photoed while the part [finishing / photography] Er1 is displayed by still picture Er1' is displayed by the animation.
[Drawing 8] When the diopter examined the eyes has shifted from the emmetropia, in order that a photography scale factor may change, it is drawing for explaining that still picture Er1' displayed on the screen and the part Er8 which should be photoed shift.
[Drawing 9] It is drawing showing the state where the vessel of still picture Er1' which rectifies a display scale factor and is shown in drawing 8 , and the vessel of the part Er8 which should be photoed were connected correctly.
[Drawing 10] They are the elements on larger scale for explaining the detail of the focus handle shown in drawing 1 .
[Drawing 11] It is drawing showing the state where connected each still picture and it displayed as a panorama picture on the screen.
[Drawing 12] It is drawing showing the state where reduced each still picture and it displayed in parallel on the screen.
[Drawing 13] It is drawing for explaining a modification with the mask board shown in the light emitting diode shown in drawing 3 , and drawing 4 , and (a) shows the modification of the array of light emitting diode, and (b) shows the modification of the array of a pinhole.
[Drawing 14] It is drawing for explaining the panorama picture acquired using the array of the light emitting diode shown in drawing 13 .
[Drawing 15] It is explanatory drawing for explaining the dynamic image obtained considering the internal fixation label as movable composition.
[Drawing 16] It is explanatory drawing in the case of acquiring the conventional panorama picture using an external fixation label.
[Drawing 17] While displaying still picture Er4' on a screen, it is drawing showing the state where the part Er11 which should be photoed was displayed in the circular frame Ci by the animation.
[Description of Notations]
8A -- Screen
9 -- Control unit (display-control means)
60 -- Operation means (display-control means)
Er1-Er9 -- Part which should be photoed
Er1'-Er9' -- Still picture

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to improvement of the ophthalmology photography equipment which photos photography parts, such as eyegrounds examined the eyes, endothelium camerae anterioris, and a cornea cross section.
[0002]
[Description of the Prior Art] From the former, the ophthalmology photography equipment which photos photography parts, such as eyegrounds examined the eyes, endothelium camerae anterioris, and a cornea cross section, is known. With this kind of ophthalmology photography equipment, for example, the fundus camera which photos eyegrounds A photograph is taken, respectively, observing each observation part which expressed as the animation on the screen of a monitor by having made into the observation part (alignment picture) each part grade which should be photoed as the whole eyegrounds portion, and was displayed on this screen. It records on a still video recorder etc. by using as a still picture each part grade which was obtained by this photography and which should be photoed, each still picture obtained by this photography is associated mutually, and it is made to display on a screen as a panorama picture.
[0003]
[Problem(s) to be Solved by the Invention] However, each still picture obtained when each fundus-of-the-eye part should be associated and it should express as this kind of ophthalmology photography equipment as a still picture on the screen of a monitor is associated, the work which sticks and is compounded is troublesome, and there is also a possibility of making a mistake in and associating each still picture, and it has been a problem when inspecting the whole eye examination-ed in the large range.
[0004] Then, while establishing a position selection means to choose as JP,9-173298,A the part which should take [examined the eyes] a photograph by the thing of an indication and recording the part which should be photoed on a record means as a still picture by photography, the photography position chosen by the position selection means is recorded on a record means, and picture control means associate each still picture based on a photography position, and it is made to make it display on a screen.
[0005] There is also no possibility of making a mistake in and associating each still picture without troubling to the work which associates each obtained still picture, sticks and is compounded according to this thing.
[0006] however, by the thing of an indication, to this JP,9-173298,A Since it is [that the photography part which photography has already finished is not displayed on a screen, but the part which it is going to photo from now on and which should be photoed is only displayed by the animation on a screen, and] while observing the eye examination-ed While observing the part which it is going to photo from now on and which should be photoed, there is a problem of being hard to grasp an interrelation with the photography part which photography has already finished intuitively.
[0007] The place which succeeded in this invention in view of the above-mentioned situation, and is made into the purpose is to offer the ophthalmology photography equipment which can take a photograph, grasping intuitively an interrelation with the photography part which photography has already finished while observing the part which it is going to photo from now on, and which should be photoed, and can acquire a panorama picture.
[0008]
[Means for Solving the Problem] After the ophthalmology photography equipment of this invention according to claim 1 observes the part which should be photoed as the whole eye examination-ed portion as an observation part, It is ophthalmology photography equipment which associates mutually the still picture which photoed the aforementioned part which should carry out photography and was obtained by this photography, and is displayed on a screen as a panorama picture. It is characterized by establishing a display-control means to control so that it relates with the aforementioned still picture and the aforementioned observation part is displayed on the aforementioned screen by the animation.
[0009] The ophthalmology photography equipment of this invention according to claim 2 is characterized by controlling the aforementioned display-control means so that the still picture which the aforementioned observation part is displayed on a part for the center section on the aforementioned screen, and is related with the aforementioned observation part is displayed on the periphery on the aforementioned screen.
[0010] The ophthalmology photography equipment of this invention according to claim 3 is characterized by preparing the display scale factor on the aforementioned screen in the amendment display scale-factor amendment means based on the diopter examined [aforementioned] the eyes.

[0011] The ophthalmology photography equipment of this invention to which the aforementioned part to which photography should be carried out is characterized by the ophthalmology photography equipment of this invention according to claim 4 being a fundus-of-the-eye part according to claim 5 After observing the part which should be photoed as the whole eye examination-ed portion as an observation part, It is ophthalmology photography equipment which associates mutually the still picture which photoed the aforementioned part which should carry out photography and was obtained by this photography, and is displayed on a screen as a panorama picture. It is characterized by having a specification means to specify on a screen either of each still picture displayed on the aforementioned screen by relating mutually, and a brilliance-control means to adjust the brightness on the screen of the still picture specified by this specification means.
[0012]
[Embodiments of the Invention] the external view of the non-**** type fundus camera as an example of the ophthalmology photography equipment concerning this invention in drawing 1 -- being shown -- this drawing 1 -- setting -- 1A -- the base and 1B -- a stand and 1C -- for frame reliance and 4, external ****** and 5A of a joy stick and 5B are [the main part of equipment, and 2 / a jaw receptacle and 3 / a photography switch and 6] TV cameras, and these composition is well-known
[0013] The interior of the main part of equipment is equipped with the lighting optical system 10 for illuminating the fundus of the eye Er examined [E] the eyes, as shown in drawing 2 , the photography optical system 20 which photos the fundus of the eye Er, observation optical-system 20', the internal ****** projection optical system 50 for projecting ****** on the fundus of the eye Er, and making an eye examination-ed ****, and the alignment optical system (illustration is omitted) for performing alignment of the main part of equipment to an eye examination-ed.
[0014] the lighting optical system 10 -- an objective lens 11 and a hole -- it has the empty mirror 12, a relay lens 13, the reflective mirror 14, a relay lens 15, the pupil Ea examined [E] the eyes and the ring opening board 16 which has ring opening 16A maintained at the conjugate relation, a condensing lens 17, and the lighting light source 18
[0015] The lighting optical system 10 illuminates the fundus of the eye by infrared light at the time of observation, illuminates the fundus of the eye by the light at the time of photography, and since the composition is well-known, it omits the detailed explanation.
[0016] The photography optical system 20 has an objective lens 11, a focussing lens 21, the image formation lens 22, and the reflective mirror 23, and TV camera 6 has image pck-up element 6a. TV camera 6 is optically connected to the photography optical system 20 through relay lens system 25A which consists of the field lens 24, a reflective mirror 25, and a relay lens 26. The image pck-up element 6a is optically maintained by the conjugate relation with the fundus of the eye Er.
[0017] observation -- optical system -- 20 -- ' -- a dichroic mirror -- 23 -- ' -- reflection -- a mirror -- 25 -- ' -- a relay lens -- 26 -- ' -- a TV camera -- six -- ' -- having . Dichroic mirror 23' reflects infrared light, and has the property which penetrates the light.
[0018] TV camera 6 is connected to the still video recorder 7 as an image recording equipment machine, and this still video recorder 7 is connected to the monitor 8. When photoing the fundus of the eye examined the eyes to the screen 8A, the part which should be photoed as the whole fundus of the eye portion is expressed on the monitor 8 as an animation as an observation part.
[0019] A ** person takes a photograph by performing alignment, observing the observation part. The part which should be photoed is recorded on the still video recorder 7 as a still picture. The still picture recorded on the still video recorder 7 is displayed on screen 8A. The monitor 8 and the still video recorder 7 are controlled by the control unit 9, and mention the detail of the control later.
[0020] Eight light emitting diodes 51b-51i arranged in the shape of a square at equal intervals around light emitting diode 51a arranged at the center, and this light emitting diode 51a as the internal ****** projection optical system 50 is shown in drawing 3 , It consists of the mask board 52 which has the pinholes 52a-52i countered and prepared in each light emitting diodes 51a-51i as shown in drawing 4 , a one-way mirror 53, the image formation lens 22, a focussing lens 21, and an objective lens 11.
[0021] The light of these light emitting diodes 51a-51i Pinholes 52a-52i, It is projected on the fundus of the eye Er as ****** through a one-way mirror 53, the image formation lens 22, a focussing lens 21, and an objective lens 11. By any of these pinholes 52a-52i a **-ed person makes turn [carry out / image formation of the pinhole image / to the fundus of the eye Er] on by fixing **** by checking this ****** by looking The direction of a **-ed person's **** to the optical axis O of the photography optical system 20 is switched, and the part which should photo the fundus of the eye Er by this is changed. Here, the part which should photo the fundus of the eye Er could be nine pieces as shown in drawing 5 .
[0022] If the part Er1 which should photo a center if light emitting diode 51a is made to turn on is photoed and light emitting diode 51b is made to turn on If the part Er2 which should photo right above is photoed and light emitting diode 51c is made to turn on If the part Er3 which should photo the diagonal right is photoed and 51d of light emitting diodes is made to turn on If the part Er4 which should photo the right is photoed and light emitting diode 51e is made to turn on If the part Er5 which should photo the diagonal below is photoed and 51f of light emitting diodes is made to turn on If the part Er6 which should photo right under is photoed and 51g of light emitting diodes is made to turn on If the part Er8 which should photo the left if the part Er7 which should photo the diagonal below is photoed and 51h of light emitting diodes is made to turn on is photoed and light emitting diode 51i is made to turn on, the part Er9 which should photo the diagonal left will be photoed.
[0023] As shown in drawing 6 , before photography, the part which should be photoed as the whole fundus of the eye Er portion is displayed on a monitor's 8 screen 8A as an alignment picture. This alignment picture is an animation. At this drawing 6 , the part Er1 which should be photoed in the abbreviation center section is displayed on screen 8A by the animation as that to which the eye examination-ed is ****(ing) light emitting diode 51a.
[0024] A control unit 9 has the operation meanses 60, such as a mouse, and the recognition pattern 61 which makes the position

of the whole fundus of the eye Er part which should be photoed recognize with an alignment picture and a static image is displayed on screen 8A by operating the operation means 60. Since a photograph has not been taken about the fundus-of-the-eye parts Er2-Er9, in drawing 6 , only the part Er1 which should be photoed is displayed and the still picture mentioned later is not displayed.

[0025] The recognition pattern 61 consists of nine grids 61a-61i here, and this nine grid 61a or 61i is arranged with the physical relationship corresponding to the photography parts Er1-Er9, respectively. If photography of the part which should be photoed, for example is performed, the brightness of the grid corresponding to the part which should be photoed this recognition pattern 61 in the state where make it become high and photography is not performed at all If the brightness of each grids 61a-61i is low brightness, for example, photography is performed by operating photography switch 5B in the state where the alignment picture of the central part Er1 is displayed Grid 61a is changed into high brightness from low brightness, and it is recognized whether photography of the part which should photo which position of the whole fundus of the eye Er part which should be photoed was performed by this. The part Er1 which should be photoed is recorded on the still video recorder 7 as still picture Er1'. Next, if 51h of light emitting diodes is made to turn on and **** examined [E] the eyes is guided, the alignment picture corresponding to the part Er8 which should be photoed to screen 8A as shown in drawing 7 will be expressed as an animation. The part Er8 which should be photoed is displayed on the abbreviation center section of screen 8A.

[0026] If the operation means 60 is operated and call specification of a desired still picture (here Er1') is carried out on screen 8A, while still picture Er1' will be displayed, the recognition pattern 61 is displayed. If this operation means 60 is operated and observation is specified on screen 8A, still picture Er1' will maintain a relative-position relation to the alignment picture Er, and will be moved to the periphery on screen 8A. It functions as a display-control means to control so that a part of still picture Er1' is displayed on screen 8A, a control unit 9 and the operation means 60 are related with a still picture on screen 8A and an observation part is displayed by the animation.

[0027] A photograph can be taken grasping intuitively an interrelation with the photography part which photography has already finished, while this is observing the part which it is going to photo from now on and which should be photoed, and a panorama picture can be acquired. Moreover, without reducing an observation part, it can display on a screen and a still picture and an observation part can be associated.

[0028] It is displayed on screen 8A that 61h of grids was changed into high brightness from low brightness, and the photography part of the fundus-of-the-eye photography part Er8 was performed in this state when photography was performed by operating photography switch 5B. In the drawing 7 , a slash shows the grids 61a and 61h which photography was performed and became high brightness. Simultaneously, the fundus-of-the-eye photography part Er8 is recorded on the still video recorder 7. In case a control unit 9 records each photography parts Er1-Er9 on the still video recorder 7, it makes photography part information record with each photography parts Er1-Er9. Here, the same signs Er1-Er9 are used as photography part information.

[0029] By the way, it considers that the diopter examined the eyes is 0 times (normal), and the relative-position relation of the parts Er1-Er9 which should be each photoed is calculated, and it is made to express to screen 8A as this ophthalmology photography equipment. However, since photography scale factors differ when it is [examined / myopia and / longsighted / the eyes] when the diopter examined the eyes is not 0 times namely, as shown in drawing 8 , there is a trouble that the animation which adjoins a still picture [finishing / photography] and this cannot be connected with a sufficient precision.

[0030] the diopter value when focusing by moving the focussing lens 21 shown in drawing 2 using focus handle 21A shown in drawing 1 in the direction of an optical axis, since the fixed relation between the diopter examined the eyes and a photography scale factor was -- being based -- the display scale factor on screen 8A -- a control unit 9 -- an amendment -- if it is made like, the animation which adjoins a still picture [finishing / photography / as shown in drawing 9], and this can be connected with a sufficient precision Graduation 21C of reference-mark 21B of a stigmatism eye position, +a (diopter), and -a (diopter) is prepared, as shown in drawing 10 , if focus button 21D is pushed when a focussing lens 21 is moved and it focuses by operating focus handle 21A, the diopter examined the eyes will be memorized by the control unit 9, and, thereby, a change of a display scale factor will be made to the circumference of focus handle 21A. At this time, a control unit 9 functions based on the diopter value examined the eyes considering a display scale factor as an amendment display scale-factor amendment means.

[0031] If it finishes photoing the each parts Er1-Er9 which should be photoed and the operation means 60 is operated, as shown in drawing 11 , a fundus-of-the-eye image will be displayed on screen 8A by still picture Er1' - Er9' as an overview (panorama picture). Here, the brightness of each still picture Er1' - Er9' is seen and measured, and suppose that there was a still picture with very high brightness or a low still picture.

[0032] In this case, a still picture with the high brightness or a low still picture is clicked and specified on the picture in which cursor is moved by the operation meanses 60, such as a mouse, and cursor is located. Then, the brilliance-control virtual slide knob 62 is displayed on screen 8A at the same time the specified still picture appears in the front face of screen 8A.

[0033] It can consider as the brightness of the still picture which operates the brilliance-control virtual slide knob 62 on a screen by the operation means 60, and adjoins each other, and brightness without sense of incongruity, each still picture is continuously connected without sense of incongruity, and the whole image examined the eyes can be compounded.

[0034] Moreover, each still picture Er1' - Er9' may be displayed on drawing 12 in parallel, the luminosity of each still picture Er1' - Er9' may be seen and compared, brilliance-control specification may be performed to every each still picture Er1' - Er9', and the brilliance control for every still picture may be performed.

[0035] Since light emitting diodes 51b-51i as ****** were considered as the square-like array the center [light emitting diode 51a], although there is the advantage in which the lap portion of the still picture (fundus-of-the-eye image) of an adjoining

fundus-of-the-eye part shown in drawing 11 can be lessened, with the form of implementation of this invention As shown in drawing 13 (a), while arranging light emitting diodes 51b-51i on a periphery focusing on light emitting diode 51a As shown in drawing 13 (b), the pinholes 52a-52i of the mask board 52 are made to correspond to light emitting diodes 51a-51i, and it arranges, and you may make it display still picture Er1' - Er9' on screen 8A, as shown in drawing 14 .

[0036] Although it enables it to photo the fundus-of-the-eye image within the limits of 80 degrees centering on the center of the fundus of the eye, you may enable it to photo the fundus-of-the-eye image within the limits of 100 degrees and 120 degrees here.

[0037] Moreover, arbitrarily, using movable ****** which can be repositioned as internal ******, as shown in drawing 15 While changing the fundus-of-the-eye part which should be photoed by displaying the circular frame Ci in the center of screen 8A before photography, displaying as an animation the fundus-of-the-eye part which should be photoed in this screen 8A, and following movable ****** on carrying out a variation rate from a criteria position You may make it change the position of the circular frame on screen 8A from a mid gear according to the amount of displacement from the criteria position of movable ******.

[0038] Although the form of implementation of the above invention explained the case where a panoramic exposure was performed using internal ****, you may be made to take a photograph using external ****.

[0039] The range which should be photoed when taking a photograph using external **** is wide range, and the ** person is taking a photograph by [as adjoining photography images' overlapping considerably], as it depends on experience and intuition so that it may photograph and there may be no remnants part, and shown in drawing 16 . The state where the pictures which adjoin the drawing 16 mutually [the still picture of 15 sheets of signs Er1-Er15] overlapped in most portion is shown.

[0040] Therefore, when the panoramic exposure of a fundus-of-the-eye image was conventionally performed using external ****, photography number of sheets increased and there was a problem of wasting a film. Then, as shown in drawing 17 , while changing the animation as a fundus-of-the-eye part which displays the circular frame Ci on a part for the center section of screen 8A, and is displayed on screen 8A with guidance examined the eyes according to external ****** within the circular frame Ci It is made to correspond to the amount of displacement from the criteria position of external ******, and you may make it move relatively the still picture [finishing / photography] to the circular frame Ci on screen 8A. Here, still picture Er4' is displayed on screen 8A as a still picture [finishing / photography].

[0041] A panorama picture can be acquired lessening the lap of the fundus-of-the-eye image which adjoins, grasping correctly the physical relationship over the still picture of the animation in the circular frame Ci which it is going to photo from now on, seeing the fundus-of-the-eye image as a still picture of screen 8A according to this thing as much as possible.

[0042]

[Effect of the Invention] The effect that a photograph can be taken grasping intuitively an interrelation with the photography part which photography has already finished while observing the part which it is going to photo from now on and which should be photoed according to the ophthalmology photography equipment of this invention according to claim 1, and a panorama picture can be acquired is done so.

[0043] Since according to the ophthalmology photography equipment of this invention according to claim 2 it displays on the center section of the screen by making an observation part into an animation and the still picture displayed the part on the periphery of a screen, without reducing most observation parts, it can display on a screen and a still picture and an observation part can be associated.

[0044] According to ophthalmology photography equipment given in the claims 3 and 4 of this invention, the change of a photography scale factor based on the diopter examined the eyes can be rectified, each adjacent still picture can be connected with a more sufficient precision, and by making especially a fundus-of-the-eye image into a panorama picture, on a screen, the blood vessel of each fundus-of-the-eye part is connected correctly, and can be displayed.

[0045] A specification means to specify on a screen either of each still picture displayed on the screen by relating mutually according to the ophthalmology photography equipment of this invention according to claim 5, Since it has a brilliance-control means to adjust the brightness on the screen of the still picture specified by this specification means, even when the brightness of each still picture displayed on the screen differs, the effect that each still picture is continuously connected without sense of incongruity, and the whole image examined the eyes can be compounded is done so.

[Translation done.]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] After observing the part which should be photoed as the whole eye examination-ed portion as an observation part, It is ophthalmology photography equipment which associates mutually the still picture which photoed the aforementioned part which should carry out photography and was obtained by this photography, and is displayed on a screen as a panorama picture. Ophthalmology photography equipment characterized by establishing a display-control means to control so that it relates with the aforementioned still picture and the aforementioned observation part is displayed on the aforementioned screen by the animation.
[Claim 2] The aforementioned display-control means is ophthalmology photography equipment according to claim 1 characterized by controlling so that the still picture which the aforementioned observation part is displayed on a part for the center section on the aforementioned screen, and is related with the aforementioned observation part is displayed on the periphery on the aforementioned screen.
[Claim 3] Ophthalmology photography equipment according to claim 1 with which the display scale factor on the aforementioned screen is prepared in the amendment display scale-factor amendment means based on the diopter examined [aforementioned] the eyes.
[Claim 4] Ophthalmology photography equipment according to claim 3 characterized by the aforementioned part which should carry out photography being a fundus-of-the-eye part.
[Claim 5] Ophthalmology photography equipment which associates mutually the still picture which photoed the aforementioned part which should carry out photography and was obtained by this photography after observing the part which should be photoed as the whole eye examination-ed portion characterized by providing the following as an observation part, and is displayed on a screen as a panorama picture. A specification means to specify on a screen either of each still picture displayed on the aforementioned screen by relating mutually. A brilliance-control means to adjust the brightness on the screen of the still picture specified by this specification means.

[Translation done.]